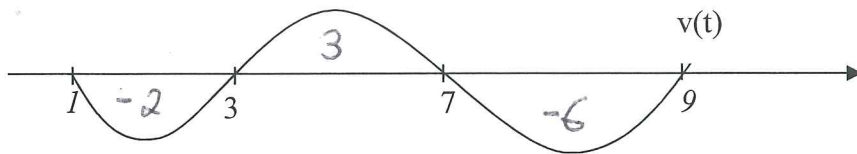


A particle moves horizontally so that its velocity at time t , for $1 \leq t \leq 9$ is given by a differentiable function v whose graph is shown above. The velocity is 0 at $t = 1, 3, 7$ and 9 and the graph has horizontal tangents at $t = 2, 5$, and 8 .

The areas of the regions bounded are 2, 3, and 6 respectively. The position function for the particle is called x and at $t = 1$, $x(1) = 2$.

- | | |
|---|--|
| a. Create Sign lines for $v(t)$ and $a(t)$ | b. On what intervals (if any) is the velocity negative? Justify your answer. |
| c. On what intervals (if any) is the acceleration positive? Justify your answer. | d. On the interval $5 < t < 7$, is the speed of the particle increasing or decreasing? Give a reason for your answer.

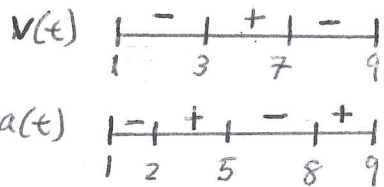
e. On the interval $7 < t < 8$, is the speed of the particle increasing or decreasing? Give a reason for your answer. |
| f. Find the positions of the particle at $t = 3$, $t = 7$ and $t = 9$. (use definite integrals.) | g. State the absolute extrema and the t -values where they occur. |
| h. Find the total distance traveled by the particle from $t = 1$ to $t = 9$. (Use Integral Notation) | i. Find the total displacement of the particle from $t = 3$ to $t = 9$. (Use Integral Notation) |
| j. Sketch graph of $x(t)$ below: | |



A particle moves horizontally so that its velocity at time t , for $1 \leq t \leq 9$ is given by a differentiable function v whose graph is shown above. The velocity is 0 at $t = 1, 3, 7$ and 9 and the graph has horizontal tangents at $t = 2, 5,$ and 8 .

The areas of the regions bounded are 2, 3, and 6 respectively. The position function for the particle is called x and at $t = 1, x(1) = 2$.

a. Create Sign lines for $v(t)$ and $a(t)$



b. On what intervals (if any) is the velocity negative? Justify your answer.

$(1,3) \cup (7,9)$ b/c $v(t) < 0$

c. On what intervals (if any) is the acceleration positive? Justify your answer.

$(2,5) \cup (8,9)$ b/c $v'(t) > 0$

d. On the interval $5 < t < 7$, is the speed of the particle increasing or decreasing? Give a reason for your answer.

Decreasing speed b/c $v(t) > 0$ and $a(t) < 0$ (opposite signs)

e. On the interval $7 < t < 8$, is the speed of the particle increasing or decreasing? Give a reason for your answer.

Increasing speed b/c $v(t) < 0$ and $a(t) < 0$ (same signs)

f. Find the positions of the particle at $t = 3, t = 7$ and $t = 9$. (use definite integrals.)

$$x(3) = x(1) + \int_1^3 v(t) dt = 2 + (-2) = 0$$

$$x(7) = x(3) + \int_3^7 v(t) dt = 0 + 3 = 3$$

$$x(9) = x(7) + \int_7^9 v(t) dt = 3 + (-6) = -3$$

g. State the absolute extrema and the t -values where they occur.

Abs min at -3 where $t = 9$

Abs max at 3 where $t = 7$

h. Find the total distance traveled by the particle from $t = 1$ to $t = 9$. (Use Integral Notation)

$$\int_1^9 |v(t)| dt = 2 + 3 + 6 = \boxed{11}$$

i. Find the total displacement of the particle from $t = 3$ to $t = 9$. (Use Integral Notation)

$$\int_3^9 v(t) dt = 3 - 6 = \boxed{-3}$$

j. Sketch graph of $x(t)$ below:

